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Actionee
Actionee Due Date:

Department of Energy
Brookhaven Site Office
P.O. Box 5000
Upton, New York 11973

MAY 2 6 2006

Mr. Michael Bebon
Brookhaven Science Associates, LLC
Brookhaven National Laboratory
Upton, New York 11973

Dear Mr. Bebon:

SUBJECT: RADIOACTIVE WASTE MANAGEMENT BASIS FOR BROOKHAVEN NATIONAL LABORATORY, REVISION 6, DATED MAY 19, 2006

Based upon our review, the subject document has been approved by the Brookhaven Site Office. Please note that the request to use commercial low level waste disposal as described in section 5.2 and Appendix B is approved by the Site Office and the Site Federal Project Director for the Brookhaven Environmental Cleanup Project has concurred. If you should have any questions, please contact Terri Kneitel, of my staff, at extension 2112.

Sincerely,

M. Holland

Michael D. Holland
Site Manager

cc: R. Rimando, EM-3.2
R. Desmarais, SC-BHSO
T. Kneitel, SC-BHSO
M. Dikeakos, SC-BHSO
G. Goode, BSA
D. Rocco, BSA

Radioactive Waste Management Basis

For

Brookhaven National Laboratory

Revision 6

May 19, 2006

Prepared by: Diane Rocco Date: 5/17/06

Diane Rocco
Environmental and Waste Management Services

Reviewed by: Mike Clancy Date: 5/17/06

Mike Clancy
Environmental and Waste Management Services

George Goode Date: 5/18/06

George Goode, Division Manager
Environmental and Waste Management Services

Edward T Lessard Date: 5-18-06

Edward Lessard
Collider-Accelerator Department

James Bullis Date: 5/18/06

James Bullis
Medical Department

Approved by: for M. B. Date: 5/18/2006

Mike Bebon, Deputy Director for Operations

Revision Log

Rev.	Date	Affected Pages	Revision
0	3/20/2001	All	Initial issue
1	11/14/2001	Various	Updated “Environmental Restoration Division (ERD)” to “Environmental Management Directorate.”
		6	Corrected title of WMD-ADM-950 to -910 (USQD). Corrected revision date for Building 811 PHA (Reference 3) to November 1995. Added Reference 4 - Supplemental Hazard Analysis for the Waste Concentration Facility (Building 811) and Waste Transfer Facility (Building 810), August 2001.
		7	Updated revision date for WMF FSAR and TSR to July 2001.
		8	Updated revision date for HWMF BIO to August 2001. Corrected revision date for HWMF PHA to May 1994. Added Reference 4 - Hazardous Waste Management Facility Transition Plan, Rev. 2, November 2000.
		9	Updated reference to BNL SBMS Hazardous Material Transportation Safety Management System (replaces BNL Onsite Transportation Safety Manual).
		11	Updated reference to WMD QA “Program Plan” to “Manual.”
		13	Section 5.2, clarified second paragraph by adding the words “non-storage for decay” (wastes), consistent with DOE M 435.1-1.
		13	Section 5.2.1, clarified first paragraph, last sentence, regarding CERCLA wastes. Deleted the word “draft” for BCP WM-01-01.
		16	Updated revision level/date for References 3, 8, 9, 10, 11, and 14. Deleted Reference 12 and renumbered. Updated revision level/date for References 8,
2	8/12/02	5	Deleted reference to underground transfer piping
		13	Added requirement to provide annual reporting to DOE of waste in storage more than 18 months.
3	3/31/03	Appendices	Added “Appendix A - O 435.1 Implementation Plan” to document the technical basis for the BNL RWMB.
		1	Revised “Abstract” to address addition of Appendix A, consideration of TRU waste, and to generalize the applicability of the RWMB to all BNL waste management activities.
		2	Revised “1.0 Introduction“ to clarify BNL generator and WM activities subject to O 435.1, including the applicability of this RWMB to TRU wastes.

Rev.	Date	Affected Pages	Revision
		5	Updated Building 801 description.
		5	Revised Building 802B discussion to state that this facility is no longer functional.
		5	Updated Building 810/811 description to remove reference to vendor RO treatment and add solidification.
		6	Updated Building 865 description to include small volume liquid solidification and compaction. Updated Building 870 description to include storage of radioactive wastes. Simplified Building 855 description as there are no radioactive waste activities performed in this building.
		7	Simplified Section 2.2 as these “Other WMD Facilities” are no longer functional. Changed Section from 2.2 to 2.1.4.
		11-14	Added new Section 2.2 to define BNL generator radioactive waste treatment activities.
		15	Revised Section 3.0 to remove reference to WMD SOPs not directly relevant to waste transportation. Updated references to SOPs.
		11-12	Section 4.0, added “transuranic.” removed reference to “Nevada Test Site,” clarified reference to 49CFR, clarified applicability of WCPP to wastes for shipment to approved offsite,TSDFs, and generalized reference to “other off-site TSDFs.”
		13	Added Section 5.1 to define generator radioactive waste management activities.
		15	Revised Section 5.3 to discuss indoor and outdoor waste storage.
		16	Deleted Section 5.3.5.
		17-18	Added Section 5.5 to define contingency transfer and storage of liquid radioactive wastes. Added Section 5.6 to define exemption approval process.
		19	Updated reference revision levels. Added DOE O 435.1 and DOE M 435.1.
		Various	Generalized reference to “Waste Management Division” due to organizational change.
		Various	Revised LLWCPP to WCPP.
		Various	Revised reference to DOE Order 5480.23 (no longer exists) to 10CFR830.202 or DOE-STD-1027-92, CH1, depending on context.

Rev.	Date	Affected Pages	Revision
4	3/31/04	8-9	Revised Section 2.2.1 to update C-AD treatment activities in accordance with letter dated 1/22/2004, Bebon to Holland, Subject: CA-D Compaction/Size Reduction Activities & Medical Freezer Storage. Deleted subsection "Compaction of Non-Dispersible Low-Level Radioactive Waste," and added subsections "Size-Reduction and Packaging of Non-Dispersible Low-Level Radioactive Waste," and "Storage of Regulated Medical Waste in Bldg 490. Revised Section 2.2.1 to update C-AD treatment activities in accordance with letter dated 11/26/2003, Bebon to Holland, Subject: Relocation of C-AD Tankers. C-AD treatment activity relocated to Bldg. 974 on Thomson Road. Revised Section 2.2.3 to update discussion of Peconic River Sludge treatment.
		17	Updated section 5.3.4 to clarify updating interface between Site-Wide Material Project and Orphaned Source Disposition Plan.
		18	Revised exception process to allow memo-form documentation of approval for small-duration exceptions to clocks
		19	Deleted duplicate reference to BNL Waste Certification Program Plan.
		5	Clarified status of liquid storage tanks in Bldg 810/811 and options for treatment of rad liquid from Bldg 801. Removed historical description of Bldg 802B.
		1	Revised text to delete the adjective "recent" from description of the discovery of TRU waste
		7	Revised discussion of "other" WM facilities to reflect transition of HWMF and Bldg 650 to EM.
		12	Updated references to CFRs on transportation
		Various	Changed BAO to BHSO throughout
5	5/31/2005	3, 11, 19	Updated titles of documents and procedures
		5	Revised Section 2.1.1 to state that Medical may adjust pH in the 801 tanks and to delete the reference to the sunsetted SAD
		7	Revised date on referenced TSR/FSAR and updated section 2.1.4
		9	Revised title of ERD in Section 2.2.3 and updated section on drying of sediments and soils
		10	Added statement to Section 2.2.4 that lime may be added to STP to suppress biological activity, and absorbent to address condensation.
		11	Rewrote last paragraph to broaden focus from Hanford to all TSDFs
		15	Revised method of obtaining DOE approval of commercial treatment, as the SDD database is no longer maintained..
		17	Added reference to project-specific waste management plans to Section 5.3.1, deleted section on EM Liability Waste, as the project is complete.

Rev.	Date	Affected Pages	Revision
6	5/19/06	Various	Updated references, titles, links and made editorial grammar changes
		8	Updated CAD Treatment Description
		9	Updated ERD Treatment Description
		10	Updated Medical Treatment Description
		15	Upadated Commercial Exemption Request Text
		17	Removed text on Site-Wide Inventory and Property Disposal Project
		Appendix B	Added Commercial Exemption Request Text
		5, 10	Relocated description of Bldg 801 tank treatment
		9,10	Reassigned Sr-90 plume treatment from ERD to EWMSD

Table of Contents

ABSTRACT

DOE Order 435.1, *Radioactive Waste Management*, and DOE Manual 435.1-1, *Radioactive Waste Management Manual*, require radioactive waste facilities, operations, and activities to have a radioactive waste management basis consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment. Brookhaven National Laboratory's (BNL) radioactive waste management activities include generator activities resulting from BNL's research programs and laboratory support operations, and the treatment, staging, storage, and certification of radioactive waste to offsite treatment, storage and disposal facilities' (TSDFs) waste acceptance requirements.

BNL prepared an Implementation Plan to document the compliance basis for each applicable element of DOE Order 435.1 and DOE Manual 435.1-1, and identified specific actions and a schedule for achieving full compliance with the Order. The Implementation Plan, approved by DOE on July 6, 2000, serves as the technical basis for this Radioactive Waste Management Basis (RWMB) document, and is provided as Appendix A to this document.

This document establishes the RWMB for all BNL radioactive waste facilities, operations, and activities by identifying the BNL management systems and requirements that govern the authorization basis documentation for BNL facilities, and the performance of BNL radioactive waste operations and activities. Additionally, this document discusses BNL's approach to some specific requirements of the Order and how BNL addresses these requirements.

The requirements of Chapter III (Transuranic Waste) of DOE Manual 435.1-1 were reviewed and found to be enveloped by the requirements of Chapter IV (Low-Level Waste), which are addressed by the Implementation Plan approved by the DOE. Therefore, the identification of transuranic (TRU) waste at BNL does not require additional controls beyond those defined within this document. BNL will make every effort to discover Defense Mission links for TRU waste, however, since non-defense TRU waste currently has no identified path to disposal, this RWMB serves as notification to DOE that such TRU waste may be stored in excess of the storage limits defined in Section 5.3, herein. TRU waste will be managed under the same procedures as other radioactive waste. BNL intends to store TRU waste that is currently ineligible for disposal at the Waste Isolation Pilot Plant (WIPP) until the DOE complex-wide problem of its disposal is resolved. For WIPP-eligible waste, BNL will abide by the WIPP transportation and disposal Waste Acceptance Criteria, and will incorporate TRU into our waste handling procedures.

The term "radioactive waste" used herein is applicable to low-level, TRU, and the radioactive component of mixed waste.

1.0 INTRODUCTION

This document establishes the Radioactive Waste Management Basis (RWMB) for Brookhaven National Laboratory (BNL). The RWMB was prepared in response to the requirements of DOE O 435.1, *Radioactive Waste Management*, and DOE M 435.1-1, *Radioactive Waste Management Manual*. The scope of the RWMB is limited to management of transuranic waste, low-level waste, and the radioactive component of mixed waste, and includes all radioactive waste management facilities, operations, and activities (including generation, treatment, and storage). BNL does not manage high level wastes, and does not operate any radioactive waste disposal facilities.

BNL generators characterize, stage, and transfer radioactive waste to the Waste Management organization (WM) within the Environmental and Waste Management Services Division for treatment, interim storage and shipment to off-site disposal facilities. BNL generators may also treat and store radioactive wastes within the authorization bases of their facilities. BNL generators certify their waste to a general acceptance profile defined by the WM. The WM acceptance profile and Radioactive Waste Control Form (RWCF)/Accountable Nuclear Material Waste Control Form (ANMWCF) are used to control this certification and onsite transfer activity, and are defined in BNL's Standards Based Management System (SBMS) subject areas "*Radioactive Waste Management*" and "*Mixed Waste Management*." The generator certification of waste to the WM acceptance profile ensures that all waste transferred across this organizational boundary is managed within the authorization basis and operating boundaries of BNL waste management facilities.

WM generally performs the onsite transfer, treatment, packaging, and interim storage prior to offsite shipment for disposal of routinely generated radioactive wastes resulting from BNL's research programs and laboratory operations support activities. Radioactive wastes are also generated by BNL's environmental remediation program and the decontamination and decommissioning (D&D) projects. WM provides technical support to these projects and certifies all BNL radioactive wastes to the waste acceptance requirements of offsite TSDFs in accordance with the BNL Waste Certification Program, prior to offsite shipment.

The BNL Radioactive Waste Management Basis is based on institutional-, facility- and activity-level controls defined by the BNL SBMS, and supported by project- and division-level implementing procedures. The BNL SBMS consists of management system descriptions and subject area documents (lab-wide procedures) to which all BNL work is required to be performed. All BNL radioactive waste facilities, operations, and activities are subject to the requirements of BNL management systems and subject areas.

The following sections of the RWMB describe how the requirements of DOE O 435.1 are integrated into the BNL SBMS. Section 2.0 identifies the BNL Management Systems governing facility authorization bases. Section 3.0 discusses the on-site transportation of radioactive waste at BNL. Section 4.0 discusses BNL's Waste Certification Program Plan. Section 5.0 documents BNL's approach and basis for compliance with specific Order requirements.

2.0 FACILITY AUTHORIZATION BASIS

DOE O 435.1 (Ref. DOE M 435.1-1 I.1.E.8) requires that " …*Radioactive waste management facilities, operations, and activities shall implement DOE Standards, DOE-STD-1027-92, Hazard Categorization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports, and/or DOE-EM-STD-5502-94, DOE Limited Standard: Hazard Baseline Documentation, and shall, as applicable, prepare and maintain hazard analysis documentation and an authorization basis as required by DOE O 425.1A, Startup and Restart of Nuclear Facilities, DOE O 5480.21, Unreviewed Safety Questions, DOE 5480.22, Technical Safety Requirements, and DOE 5480.23, Nuclear Safety Analysis Reports."*

BNL operates and maintains a wide range of facilities to support its diverse mission of basic and applied research. Requirements for safety analysis documentation, including the level of rigor of analysis and the ultimate approval authority, are governed by the type of BNL facility requiring safety documentation. Nuclear facilities requiring Safety Analysis Reports (SARs) fall under the requirements of 10 CFR 830 Subpart B. Accelerator Facilities requiring a Safety Analysis Document (SAD) fall under the requirements of DOE Order 420.2B "Safety of Accelerator Facilities," and facilities that are neither nuclear nor accelerator are covered under DOE Order 420.1B "Facility Safety." The BNL SBMS *Management System Description: Facility Safety* defines the requirements and processes for facility and research personnel to analyze hazards and risks, and to develop and implement controls to manage hazards that might impact the environment, the health and safety of the worker, or the public.

SBMS subject area *"Facility Hazard Categorization"* provides guidelines for the determination of a Facility Hazard Category for each existing and new facility at the Laboratory. Facility hazard categorization is based on the radioactive and chemical inventory within a facility and their associated hazard potential. Hazards are evaluated in compliance with 10 CFR 830 Subpart B, "*Safety Basis Requirements*," DOE Standard 1027-92, *"Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23;"* and OSHA Process Safety Management of Highly Hazardous Chemicals (29 CFR 1910.119). The Facility Hazard Category determines the type of facility and subsequent requirements for safety documentation, authorization basis, and approval authority for operation of the facility.

BNL's Integrated Safety Management System (ISMS) defines SBMS as providing the policies, standards of performance, Laboratory-wide procedures, and guidelines governing the work that BNL staff perform, and as implementing the applicable external requirements (DOE Directives, and Federal, State, and local statutes, regulations, and permit requirements). The *BNL Standards Based Management System* is delivered on-line using hypertext mark-up language (HTML). The content of the information is protected through a rigorous change control process. Therefore, the on-line information is the only official copy of the materials, eliminating the need for distributing and managing the information by controlled hard copy.

The BNL SBMS Management System Description: Facility Operations, defines the Facility Operations Management System (FOMS) responsibility for ensuring that each BNL facility can be effectively and efficiently used and operated within an established operational safety envelope. The FOMS also provides the stewardship of the process for *Facility Use Agreements*

(FUAs), which define boundaries for operations and conditions in the facility and interfaces between facility occupants and service providers.

The FOMS relies upon key Laboratory processes that identify potential risk to employees, visitors, guests, the public, and the environment that result from facility occupant activities, and establishes engineered and administrative controls to manage that risk. The administrative control to manage risks at the facility level is the FUA. The FUA is developed to specify the operational safety limits (i.e., Technical Safety Requirements (TSRs), Accelerator Safety Envelopes (ASEs), Environmental Impact Envelopes) of the facility, to clearly establish facility operational roles, responsibilities, accountabilities and authorities, to define interfaces between occupant organizations and service providers, and to provide for interface management. The FUA document serves as a tool for short-and long-term work planning by providing a ready reference source of the facility capabilities and capacity. It categorizes facilities and provides a facility-based, activity hazard assessment that allows for efficient selection of work locations across the Laboratory.

FUAs serve as the operational and occupancy agreement between the Deputy Director for Operations (acting on behalf of the Laboratory Director as landlord), the principal occupant organization, and BNL service-provider organizations. FUAs have been developed and approved for all BNL facilities.

Activity-level requirements for BNL are defined in the SBMS *Management System Description: Work Planning and Control* (WP&C). The WP&C management system ensures that all work is planned and performed properly, hazards and risks are identified and controlled, resources are scheduled and coordinated, and appropriate feedback mechanisms are in place. For this management system, "work" is defined as the activities that involve the design, operation, maintenance, modification, construction, demolition, or decontamination of facilities, systems, or experiments by BNL or non-BNL personnel, and includes BNL radioactive waste management operations and activities. The WP&C management controls the experimental design; the project planning, management and status reporting (capital and expense projects); the maintenance, repair, and modification work planning; and the standard operating procedures (SOPs) work processes. This system also maintains the BNL SBMS Subject Area: *Work Planning and Control for Experiments and Operations* which requires consideration of the FUA to assure that work activities do not adversely impact the hazard classification, safety envelope, or environmental envelope of the facility.

Authorization Basis:

The following BNL management systems, as discussed above, constitute the authorization basis for all BNL facilities, including WM facilities and generator facilities in which radioactive waste management activities may be conducted.

1. SBMS *"Management System Description: Facility Safety"*

2. SBMS subject area *"Facility Hazard Categorization"*

3. SBMS *"Management System Description: Facility Operations"*

4. SBMS subject area *"Facility Use Agreements"*

5. BNL list of active *"Facility Use Agreements"*

6. SBMS *"Management System Description: Work Planning and Control"*

7. SBMS subject area "*Work Planning and Control for Experiments and Operations*"

2.1 WM Radioactive Waste Facilities

WM operates facilities for the treatment and temporary storage of radioactive waste. One of these facilities is classified as a Nuclear Hazard Category 3 facility, and the remaining are classified as radiological facilities based on DOE-STD-1027-92, Change 1, *"Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports."* These facilities are discussed as follows:

2.1.1 Buildings 810/811

Building 810/811, the Waste Concentration Facility (WCF), is the central facility for the receipt, storage and processing of aqueous radioactive waste at BNL. The WCF is currently used primarily as a collection and interim storage facility for the radioactive liquid waste stream. The WCF includes four aboveground tanks (D-Waste Tanks #1-4) located in the northwest corner of the WCF yard. Tanks #1 and #2, which are currently out of service, have a capacity of 22,000-gallons each and tanks #3 and #4 have a capacity of 18,000-gallons each. Aqueous wastes are transferred offsite for treatment and disposal or solidified and sent offsite for disposal. The WCF is classified as a Radiological Facility.

All current work activities at the WCF are conducted under the control of existing WM SOPs or Technical Work Documents prepared in accordance with the WM-ADM-940, Preparation of Procedures. Consistent with the requirements of BNL's SBMS Management System Description: Work Planning and Control, this SOP requires the performance of a job hazard screening review to determine the adequacy of defined work controls based on the ESH&Q issues, job complexity/uncertainty, and work coordination requirements. Spare capacity is administratively maintained in the WCF's liquid waste storage tanks for the purpose of providing contingency storage capability for BNL in accordance with the requirements of DOE Order 435.1. BNL's approach to contingency storage is discussed in more detail in Section 5.5.

Authorization Basis:

1. Waste Concentration Facility (Buildings 810 & 811) Facility Use Agreement

2. Preliminary Hazard Analysis for the Waste Concentration Facility (Building 811), November 1995.

3. Supplemental Hazard Analysis for the Waste Concentration Facility (Building 811) and Waste Transfer Facility (Building 810), August 2001.

2.1.2 Waste Management Facility

The Waste Management Facility (WMF) includes an Operations Building, a RCRA Waste Building, a Mixed Waste Building, and a Radwaste Reclamation Building. An overview of each building is provided below:

- **Operations Building (Building 860):** The Operations Building is designed as an administrative facility. This building provides office space for the Waste Management staff and a shop and garage area. In addition, this building provides showers and a change area.

- **Reclamation Building (Building 865):** The Reclamation Building is the primary facility for radioactive waste handling, size reduction, small volume liquid solidification, compaction, and packaging of material (for subsequent off-site disposal). This building receives bulk radioactive waste of various sizes and configurations to be disassembled, decontaminated, size reduced and/or packaged for temporary storage prior to shipment off-site. Based upon historical plant operations, and on WMF administrative controls, criticality is not considered to be a concern. Building 865 is one of the two buildings comprising the Nuclear Hazard Category 3 facility within the WMF.

- **Mixed Waste Building (Building 870):** The Mixed Waste Building is a warehouse facility for temporary storage of liquid and solid mixed and radioactive wastes, and hazardous and industrial waste. Waste is received and managed in this facility and held until transport has been set for shipment off-site. Treatment activities in Building 870 may include neutralization or size reduction. Building 870 is one of the two buildings comprising the Nuclear Hazard Category 3 facility within the WMF.

- **RCRA Waste Building (Building 855):** The RCRA Waste Building is used to store solid and liquid hazardous wastes in compliance with the Resource Conservation and Recovery Act (RCRA).

The WMF was designed to meet all current applicable federal, state, local, county and town environmental requirements. It was also designed to meet the various DOE orders governing the design and ultimate construction, as well as operation of these types of facilities. Based upon the hazard assessment, the safety analysis report (SAR) and an evaluation of the facilities inventory, portions of the WMF are classified as a Non-reactor Nuclear Hazard Category 3 facility. Administrative controls, documented in the WMF SAR and Technical Safety Requirements, ensure that the inventory levels of the WMF do not exceed a Nuclear Hazard Category 3 level, nor pose a criticality concern. In accordance with DOE-STD-1027-92, Change 1, administrative controls are an acceptable means of managing/controlling operations of a Nuclear Hazard Category 3 facility. Contingency storage requirements of DOE Order 435.1 are addressed in WM liquid waste handling SOPs and discussed below in Section 5.5.

Authorization Basis:

1. Waste Management Facility Facility Use Agreement
2. Final Safety Analysis Report for Waste Management Facility, June 2005.

3. Waste Management Facility Technical Safety Requirements, June 2005.

2.1.3 Other WM Radioactive Waste Facilities

BNL radioactive waste management activities are principally conducted in the WM facilities addressed above. Three BNL facilities, previously used by WM, are no longer functional. The Former Hazardous Waste Management Facility have been turned over to BNL's Environmental Management Directorate. Building 650 (the old Reclamation Facility) is managed by Plant Engineering. Building 650A, a small storage building adjacent to Building 650, is still under WM management but is slated for demolition. Reactivation of Building 650A for any radioactive waste management activity is not anticipated, and is planned for D&D in the FY 2006.

2.1.4 BNL Generator Treatment Activities

BNL radioactive waste management activities are principally conducted in the facilities addressed in Section 2.1, above. Waste treatment activities may also be performed in BNL generator facilities. Routine generator waste treatment activities include small-scale (less than 55 gallons per year) volume reduction and compaction, size reduction, stabilization, evaporation, filtration, and neutralization. Such small-scale waste treatment activities are managed within the facility safety envelope as defined by the generator Facility Use Agreement, and performed in accordance with the BNL SBMS Subject Area: *Work Planning and Control of Experiments and Operations*, which insures that work activities are performed safely, and do not adversely impact the hazard classification, facility safety envelope, or environmental envelope of the facility. New, larger scale generator waste treatment activities will be identified to and approved by the DOE Brookhaven Site Office (BHSO). Current large-scale waste treatment activities are described below.

2.2 BNL Generator Treatment Facilities

2.2.1 Collider Accelerator Department

Treatment of Radioactive Liquid in Tankers

The Collider Accelerator Department (C-AD) waste treatment activity includes the application of steam heat to the liquid in the Collider-Accelerator Department (C-AD) tankers in Building 974 on Thomson Road. This treatment process has been approved by the DOE BHSO per letter from Michael Holland to Thomas Sheridan dated January 2, 2003. The three 7000-gallon tankers are used to hold radioactive liquid removed from C-AD process equipment and well sampling pending opportunities for re-insertion and reuse of the liquid in the C-AD process equipment. The application of steam heat for freeze protection results in evaporation of tritium-contaminated liquid from the tanks, creating an airborne emission. BNL considers this evaporation process to be treatment of liquid radioactive waste. This operation has been reviewed under NESHAPS and is conducted under the existing set of BNL and C-AD controls and procedures that govern the use of the tankers. These existing controls protect the workers, public, and environment, and assure compliance with applicable regulations such as New York State's Suffolk County Article 12. See Section 5.5 for discussion of BNL's approach to contingency storage for liquid radioactive waste.

Size-Reduction and Packaging of Non-Dispersible Low-Level Radioactive Waste

A dedicated area for low-level radioactive waste packaging is located in the area vacated by the Bubble Chamber Facility, Building 960. This area serves as a radioactive and mixed waste packaging area for C-A Department. Waste storage bins (B-25, B-12, B-52 bins, 55-gallon drums) are staged in this area for routine waste packaging. Full bins are surveyed, characterized, and paperwork sent to the WM organization, who pick up completed bins for final shipment. An old building structure in the area is used for waste sorting, cutting and sizing materials, decay in storage, and as a solid mixed waste satellite area. All work in this building is done in compliance with the requirements of the Subject Area: *Work Planning and Control for Experiments and Operations* and C-AD procedures.

Disposal of Tritiated Water to the Sanitary Sewer System

Activated cooling-water systems contain several radionuclides, but tritium is the only nuclide of environmental significance since it has a long half-life (12.3 years). About 100,000 gallons of tritiated cooling water is contained in the closed-looped, secondarily contained cooling-systems at C-AD. Total tritium inventory in this water is about 30 mCi ($1x10^9$ Bq). Optimizing the beam transport through beam-line components minimizes activation of cooling water but there will always be tritium. Because discharge of tritiated water to the sanitary sewer is discouraged by the Laboratory, activated water is retained in tankers during maintenance and returned to tritiated cooling-water systems whenever possible. In the event that cooling water cannot be re-used in the system, it is evaporated in accordance with approved C-A procedures and NESHAPS, or if it meets SBMS and SPDES requirements, it may be released in a controlled manner to the sanitary sewer system.

2.2.2 Environmental Sciences Department

The Environmental Sciences Department (ESD) performs research in the fields of alternative waste treatment technologies and contamination transport mechanisms. Treatment of waste, being their core research mission, may be performed within their facilities as a routine part of their experimental work. This aspect of treatment is not considered governed by the DOE Order 435.1. Radioactive waste no longer part of the research cycle is subject to the Order's requirements, and may be treated by neutralization, solidification or size reduction on a small scale i.e., less than 55-gallons per year. Larger scale generator waste treatment activities will be identified to and approved by the DOE BHSO.

2.2.3 Environmental Restoration Projects

BNL's Environmental Restoration Projects (ERD) manages Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup activities and other remediation and D&D activities, including the decontamination and decommissioning of the Brookhaven Graphite Research Reactor (BGRR) and the High Flux Beam Reactor (HFBR). ERD waste treatment activities include the following:

Drying of Sediments and Soil

ERD may perform a treatment process for the remediation of the Waste Loading Area at the Former Hazardous Waste Management Facility. The process consists of drying the material in drying beds, adding a absorbent agent as needed, and mixing. The treated material is transferred to Supersacks, or direct-loaded into railcars, for disposal. This treatment activity is performed in accordance with the requirements of the BNL SBMS Subject Area: *Work Planning and Control for Experiments and Operations* and ERD procedures.

Size Reduction of Debris

ERD periodically performs size reduction of radioactively contaminated waste items to allow for more efficient packing and transportation, and disposal cost savings. This operation may be conducted by use of hydraulic shears, disassembly, or other means. This treatment activity is performed in accordance with the requirements of the BNL SBMS Subject Area: ***Work Planning and Control for Experiments and Operations*** and ERD procedures.

2.2.4 Plant Engineering

The Plant Engineering Division operates the BNL Sewage Treatment Plant (STP). STP operations result in the generation of solid radioactive wastes in the form of dried sludges. A drying shed equipped with plastic filters is used to separate water from sludge, and the slightly radiological sludge is then dried on drying tables. The water is reintroduced into the system. Once the sludge is dried, it is containerized for disposal. Lime may be added to suppress biological activity, and absorbent may be added to address condensation issues. The STP sludge drying waste treatment activity is performed in accordance with the requirements of the BNL SBMS Subject Area: *Work Planning and Control for Experiments and Operations* and Plant Engineering procedures.

2.2.5 Medical Department

Storage of Radioactive Regulated Medical/Biological Waste in Bldg 490

Radioactive regulated medical waste (R-RMW) is stored in Bldg. 490 (Room 9-174C locked Cold-Room and in the Bldg. 490 basement within locked freezers) until sufficient quantities of material are aggregated to justify shipments for disposal. Shipments typically occur about every three years. The putrescible items (e.g. animal carcasses) are kept frozen to maintain their non-putrescible state and to minimize the potential for the transfer of biological hazards to personnel. As freezer storage capabilities do not exist in the WMF, the R-RMW is stored in the above areas within designated Radioactive Materials Storage Areas in conformance with Radiological Control Division procedures and in conformance with applicable SBMS requirements for radioactive work permits, radioactive waste and regulated medical waste. The Medical Department, in coordination with the ESH&Q Department, controls the acceptance of material, the storage, packaging and proper shipment for off-site transport, and maintenance of material in this storage area in accordance with all applicable site requirements.

Building 801 Tanks

Building 801, the Isotope Research and Processing Laboratory Hot Area, contains three 500-gallon liquid waste hold-up tanks where aqueous radioactive waste is collected prior to acceptance and either 1) transferred by WM to Building 810/811 for treatment and/or interim storage prior to offsite disposal or 2) solidified by WM prior to shipment to offsite disposal. Medical may adjust the pH of the liquid in the 801 tanks to maintain tank parameters in a desirable range. Building 801 is classified as a Radiological Facility. See Section 5.5 for discussion of BNL's approach to contingency storage for liquid radioactive waste.

2.2.6 Environmental and Waste Management Services Division

Sr-90 Plume/Resin Treatment

EWMSD performs treatment of groundwater plumes for removal of Sr-90. This is managed by the LEOSS group. The process consists of pumping extracted groundwater through resin filters. The filtered water is injected back into the groundwater. Spent filters are drained, a solidification agent added, and the solidified filters are disposed. This treatment activity is performed in accordance with the requirements of the BNL SBMS Subject Area: *Work Planning and Control for Experiments and Operations* and LEOSS procedures.

3.0 ON-SITE TRANSPORTATION OF RADIOACTIVE WASTE

DOE O 435.1 (Ref. DOE M 435.1-1 I.1.E.11) requires that " … *Radioactive waste shall be packaged and transported in accordance with DOE O 460.1A, Packaging and Transportation Safety, and DOE O 460.2, Departmental Materials Transportation and Packaging Management."*

The onsite transport of BNL radioactive materials is performed in accordance with the requirements of the BNL SBMS *Management System: Hazardous Material Transportation Safety*, which implements the requirements of DOE O 460.1B and DOE O 460.2A for the BNL Site.

WM generally performs the onsite transfer, treatment, and interim storage of routinely generated radioactive wastes resulting for BNL's research programs and laboratory operations support activities. The WM Standard Operating Procedures (SOPs) are utilized to provide activity-level controls for the WM's radioactive waste activities and include the requirements of DOE O 460.1B and DOE O 460.2A. These SOPs address the loading and unloading of vehicles, hazards assessment/classification, appropriate waste packaging, and required documentation needed to identify and track the waste.

The Waste Control Form (WCF) is central to this evaluation and is the tool used by the WM to assess hazards, and determine packaging requirements or special handling requirements for onsite transfers of radioactive and hazardous wastes. The WCF is used by the WM as an onsite shipping paper.

Authorization Basis:

1. SBMS *"Management System Description: Radiological Control"*
2. SBMS *"Management System Description: Hazardous Material Transportation Safety"*
3. SBMS subject area *"Transfer of Radioactive Materials Onsite"*
4. WMD-SOP-510, Review of Radioactive and Accountable Nuclear Material Waste Control Forms
5. WMD-SOP-572, Managing Radioactive Materials at the WMF
6. WMD-SOP-578, Shipping Low-Level Radioactive Waste
7. WMD-SOP-650, Shipping Mixed Waste

4.0 RADIOACTIVE WASTE CERTIFICATION PROGRAM

DOE M 435.1 requires that the RWMB include minimum controls to ensure the protection of workers, the public, and the environment. Specific management controls required by the Order and applicable to BNL are:

1) ***Generators***. *The waste certification program.*

2) ***Treatment Facilities***. *The waste acceptance requirements and the waste certification program.*

3) ***Storage Facilities***. *The waste acceptance requirements and the waste certification program.*

This section describes how BNL complies with these minimum requirements.

- The BNL *"Waste Certification Program Plan"* (WCPP) defines requirements to meet waste stream characterization and waste acceptance criteria (WAC) for waste form, packaging, certification, and transfer of low-level waste (LLW), transuranic (TRU) and mixed waste. The purpose of the WCPP is to describe how LLW, TRU and mixed waste from BNL are certified for shipment to approved offsite Treatment, Storage, and Disposal Facilities (TSDFs). The BNL WCPP applies to all activities associated with LLW, TRU and mixed waste certification at BNL and satisfies the requirements of the commercial disposal sites commonly used by BNL.

Other requirements met by the WCPP are established in the following:

- Other applicable TSDF waste acceptance criteria;
- 49 CFR Parts 100 – 185, Subtitle B--Other Regulations Relating to Transportation, Chapter 1, Research and Special Programs Administration, Department of Transportation; and
- Department of Energy Order 435.1, Radioactive Waste Management.

BNL complies with the requirements of the documents listed above through the execution of this plan and its accompanying implementing procedures. The WCPP applies to all waste characterization and certification activities performed at BNL for radioactive wastes destined for offsite disposal.

Waste management activities are conducted by procedures developed to comply with the many applicable federal laws and regulations, DOE Orders, and off-site facility waste acceptance criteria. The BNL WCPP is established by implementing those components of the policies and procedures applicable to waste certification. When preparing waste for offsite disposal, BNL generators certify their waste to a general acceptance profile defined by WM. The WM acceptance profile and Radioactive Waste Control Form used to control this certification and onsite transfer activity are defined in BNL's Standards Based Management System (SBMS) subject areas *"Radioactive Waste Management,"* addressing the requirements for both low-level and transuranic radioactive wastes, and *"Mixed Waste Management."* The generator certification of waste to the WM acceptance profile ensures that all waste transferred across this

organizational boundary is managed within the authorization basis and operating boundaries of WM waste management facilities.

The WM onsite waste processing operations, such as handling, treatment, interim storage and shipping, are performed in accordance with *WM Standard Operating Procedures* (SOPs), the WM Conduct of Operations Policy, and the WM Quality Assurance Plan. Personnel qualifications, training, certification, and characterization activities are also described in these documents.

BNL ships mixed, transuranic and low-level radioactive waste for treatment and disposal at off-site DOE and commercial facilities. WM is considered the site waste generator by off-site treatment and disposal facilities. Individuals at BNL who generate wastes are considered onsite waste generators by the WM. Onsite waste generators are trained to meet the WM requirements to ensure compliance with the off-site treatment and disposal facilities' Waste Acceptance Criteria (WAC). The program for certifying low-level waste to off-site waste treatment and disposal WAC is described in WM SOPs. The program includes waste characterization, designation, traceability, segregation, packaging, minimization, quality assurance, and training. In certifying waste for disposal, BNL makes extensive use of documented process knowledge in waste characterization.

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5.0 BNL IMPLEMENTATION OF DOE ORDER 435.1

This section describes how BNL meets certain requirements in DOE O 435.1 and DOE M 435.1.

5.1 Generator Radioactive Waste Management Activities

Protection of workers, the public, and the environment from hazards associated with radioactive material (including wastes) is provided by the controls implemented by the SBMS (e.g., Radiological Control Management System and implementing subject areas, Environmental Management System and implementing subject areas, etc). Appendix A of this document, Assessment and Implementation Plan for Compliance with DOE Order 435.1 "Radioactive Waste Management", provides a crosswalk of Order requirements and SBMS controls.

The Laboratory's Environmental Management System (EMS) was designed to meet the rigorous requirements of the globally recognized International Organization for Standardization (ISO) 14001 environmental management standard, with additional emphasis on compliance, pollution prevention, and community involvement. The EMS ensures that environmental issues, including radioactive waste activities and operations, are systematically identified, controlled, and monitored. Moreover, the EMS provides mechanisms for responding to changing conditions and requirements, reporting on environmental performance, and reinforcing continual improvement.

The EMS subject area *Identification of Significant Environmental Aspects and Impacts* requires all BNL organizations to identify activities, products, or services that have environmental aspects that could significantly impact the environment. The Work Planning and Control system is the primary method for aspect identification. The EMS defines low-level waste, mixed waste, and transuranic waste generation (in any amount) as significant environmental aspects. Additionally, storage of radioactive material, radioactive airborne emissions, and radioactive liquid effluents are all defined as significant. The EMS requires operational controls to be applied to all significant environmental aspects. Some of the key operational controls applicable to the radioactive waste activities and operations include:

- SBMS subject areas Radioactive Waste Management and Mixed Waste Management, which define packaging, labeling, characterization and interim storage requirements for these waste types;
- SBMS subject area Radioactive Airborne Emissions, which implements National Emissions Standard for Hazardous Air Pollutants (NESHAPs) requirements;
- SBMS subject area Liquid Effluents, which implements Clean Water Act requirements; and
- SBMS subject area Storage and Transfer of Hazardous and Nonhazardous Materials, which implements Suffolk County Sanitary Code, Article 12 Standard requirements.

These requirements and the others identified in Appendix A control radioactive waste generator activities and operations in accordance with the requirements of DOE O 435.1.

In accordance with BNL's commitment to pollution prevention, some radioactive waste generated by research, support, and clean-up operations may be reused or recycled. When a decision is made to discard radioactive waste to offsite disposal, a Waste Control Form is

completed for entry into the Waste Tracking System and the additional safeguards of DOE O 435.1 are applied.

5.2 Approval of Exemptions for Use of Non-DOE Facilities

DOE M 435.1 Requirement I.2.F.(4)

DOE radioactive waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste is generated, if practical; or at another DOE facility.

Requirement I.2.F.(4) specifies that DOE facilities at the site where the waste was generated shall be used to treat, store, and, for low-level waste, dispose of the waste, if practical. Otherwise, other DOE facilities at another site should be used. In accordance with this requirement, it is BNL's policy to treat and dispose of radioactive waste at DOE-managed facilities except when permission has been granted by DOE to use commercial facilities.

The authority to grant an exemption to use a non-DOE waste management facility is delegated by DOE M 435.1 to the DOE Field Element Manager. For an exemption to be granted, certain conditions must be met and documented. For example, the Field Element Manager must determine that the use of a non-DOE facility is in the best interests of the government, is acceptable based on an annual review of the intended facility, and that the waste meets permit and license conditions for that facility.

Mixed Waste Disposal: A general exemption for mixed low-level waste disposal is granted through memorandum, Lytle and Whitfield, October 12, 1993.

Mixed and Low-Level Waste Treatment: To simplify processing of exemptions and meet the intent of the Order, Requirement I.2.F.(4) for commercial treatment, exemptions will be carried out at BNL by providing the BHSO with an annual projection of radioactive waste to be treated at commercial facilities.

Radioactive Waste Disposal: To simplify processing of commercial disposal exemptions for treatment and disposal of radioactive waste, and to meet the intent of the Order, exemption requests including evaluation of life-cycle costs for disposal at commercial facilities will be documented in Appendix B of the RWMB and updated annually with the annual update of the RWMB. Appendix B contains the current commercial disposal exemption request and cost backup to demonstrate that use of commercial facilities is in the best interests of the DOE. Approval of this RWMB by the DOE constitutes approval of these commercial disposal exemption requests.

5.3 Storage Limit for Low-Level Waste

DOE M 435.1 Requirement IV.N.(2)

"Low-level waste that has an identified path to disposal shall not be stored longer than one year prior to disposal, except for storage for decay, or as otherwise authorized by the Field Element Manager."

BNL's practice is to ship radioactive waste to a disposal facility as soon as possible. Because BNL deals with relatively small quantities of radioactive waste streams having a wide range of characteristics, accumulating enough of certain waste streams for their economical treatment, certification, and shipment within one year is not always practical. BNL periodically monitors the waste inventory with the objective of reducing its overall volume. Radioactive wastes are currently being stored inside buildings for protection against the weather, or outside in accordance with the requirements of the SBMS subject area *"Storage and Transfer of Hazardous and Nonhazardous Materials,"* which defines design and operational requirements to ensure safe storage. Activated materials free of dispersible radioactivity may be stored outdoors without an additional container. The storage of radioactive wastes for longer than one year on the BNL site does not pose a significant added risk to workers, the public, or the environment.

In general, Low-level wastes which reach a one-year storage date within the first half of a fiscal year will be shipped from the site for disposal no later than the end of the same fiscal year. Similarly, low-level wastes which reach a one-year storage date within the second half of a fiscal year will be shipped from the site for disposal no later than the end of the first half of the next fiscal year. Decay in storage wastes are exempt from storage clocks per DOE M 435.1 Chapter IV, Item N (2). Transuranic wastes are also exempt from storage clocks per DOE M 435.1, Chapter III.

Temporary volume increases in the waste inventory may occur when managing waste from specific projects or cleanout activities. BNL will operate to reduce the inventory of stored radioactive wastes in a timely manner, with consideration of the safety, cost effectiveness, and operational efficiency of waste disposal activities.

Specific wastes streams are known from past experience to be difficult and not cost effective to dispose of within one year based on volume, and/or specialized handling, packaging, and transportation requirements. These items are discussed in Sections 5.3.1 and 5.3.2 with BNL's planned disposal schedule. BNL will use the exception process defined in Section 5.6 to document necessary and justifiable changes in plan.

At the end of each fiscal year, the WMD will provide the DOE BHSO with a report summarizing all waste in storage which is more than 18 months old, and the waste category (e.g., remote-handled waste) which defines its extended disposal schedule.

Environmental Restoration Projects

SBMS "Management System Description: Environmental Management System" describes the Environmental Restoration (ER) management system that ensures that cleanup of contaminated soils, groundwater, and facilities is accomplished safely, efficiently, cost-effectively, and in a

manner that meets all performance objectives and complies with applicable federal, state, and local laws and regulations, and defines that the ER management system operates in accordance with the CERCLA process. Such ER projects are subject to multi-party agreements with regard to the approach, schedule and performance objectives. Radioactive wastes generated from BNL ER projects will be safely staged, stored and disposed of consistent with the requirements of the CERCLA multi-party agreements. ER activities may also include non-CERCLA projects, such as facility decontamination and decommissioning. ER radioactive wastes that are staged or stored prior to transfer to offsite treatment or disposal will have a documented hazard evaluation which determines that their storage configuration provides appropriate controls, commensurate with the hazard of the material, to assure protection of the workers, environment and public. The DOE-approved schedule and budget agreements create the upper tier, project summary level schedule for disposal of ER radioactive waste. Detailed plans and schedules for disposal of ER radioactive wastes are documented in the BNL-approved Environmental Management Directorate's Waste Management Plans and the approved project specific Waste Management Plan. These schedules determine the appropriate timeframes in which ERD-managed waste will be staged, stored, and disposed.

Remote-Handled Wastes

Certain BNL radioactive wastes have radioactive characteristics (>100 mrem on contact) which cause them to require special handling. These items are generated occasionally in small volumes and may require special consideration for decay in storage, remote handling, packaging, and transportation (e.g., scheduling Type B casks/containers), as well as ALARA concerns. Such BNL items include BLIP targets, sources, and other highly activated materials. Due to ALARA considerations, as well as the safety, cost effectiveness, and operational efficiency of waste disposal activities, BNL will observe a maximum three year clock for disposal on such items. This three year storage limit for remote-handled wastes is based on analysis of rates of consistently generated remote handled waste, which shows that three years of generation is required to result in sufficient quantities to cost-effectively ship one cask/container. BNL will dispose of such remote-handled wastes as sufficient quantities are generated to provide for cost-effective shipment, but not to exceed a three-year storage limit.

5.4 Waste with No Identified Path to Disposal

DOE M 435.1 Requirement III.H.(2) and IV.H.(2)

"…waste streams with no identified path to disposal shall be generated only in accordance with approved conditions which, at a minimum, shall address:

(a) Programmatic need to generate the waste;

(b) Characteristics and issues preventing the disposal of the waste;

(c) Safe storage of the waste until disposal can be achieved; and

(d) Activities and plans for achieving final disposal of the waste."

The BNL SBMS Subject Area*: Work Planning and Control for Experiments and Operations* requires assurance of an identified path to disposal for all work activities that will result in the generation of radioactive waste prior to generation. The WM provides subject matter expertise to waste generators in the determination of waste streams that have paths to disposal and those that do not. If a generator cannot identify that a waste stream has a path to disposal, then the WM will assist the generator in making this determination. The generators will first consider alternative processes, techniques, and/or materials to avoid generating such a waste stream. When a proposed waste stream has been identified as not having a path to disposal, then a request for approval to generate the waste stream will be prepared with the required information and submitted to DOE for approval.

5.5 Contingency Storage for Liquid Radioactive Wastes

Any liquid radioactive waste accumulated on the BNL site in volumes greater than 250 gallons in single-walled containers without secondary containment, will be provided with contingency storage capacity. This capacity is provided via WM's administratively maintained spare volume in the D-Waste storage tanks located in Building 810/811. 24,000 gallons of spare volume is available in these tanks, which is sufficient for this purpose. Designated transfer equipment (pumps and hoses) are inspected and tested twice a year to assure functionality in the event of an emergency. Operator aids for the fire department and the site supervisor assure the WM Local Emergency Coordinator is notified in the event of a liquid radioactive waste spill.

5.6 Exception Approval Process

Deviations from management controls and commitments described by this RWMB will be evaluated to determine the effect that the proposed deviation would have on worker, public, or environmental impact. Deviations from the storage clocks described in Section 5.3 which will not extend the clock more than six months may be requested via email to the DOE Waste Management Program Manager. The request and its approval will be filed per existing Document Control procedures at the WMF. All other deviations will be submitted via letter describing the proposed deviation, basis for ensuring safety and environmental protection, and schedule, to the DOE Waste Management Program Manager for approval prior to implementation.

6.0 RELATED REFERENCES

1. Energy Solutions, LLC Bulk Waste Facility Bulk Waste Acceptance Criteria
2. Energy Solutions, LLC Containerized Waste Facility Waste Acceptance Criteria
3. BNL Waste Certification Program Plan
4. BNL SBMS Subject Area, “Radioactive Waste Management”
5. BNL SBMS Subject Area, “Mixed Waste Management”
6. BNL SBMS Subject Area, “Facility Use Agreements”
7. BNL SBMS “Management System Description, Work Planning and Control”
8. WMP-012, Final Safety Analysis Report for Waste Management Facility
9. WMP-011, Waste Management Facility Technical Safety Requirements
10. WMP-002, Waste Management Program Conduct of Operations
11. WMP-013, Quality Assurance Plan for the Waste Management Program
12. Waste Management Standard Operating Procedures
13. WMP-009, Waste Management Division Local Emergency Plan
14. BNL Integrated Safety Management System Program Description
15. BNL SBMS “Management System Description: Emergency Preparedness”
16. BNL SBMS Program Description “Radiological Control Manual”
17. DOE O 435.1, ”Radioactive Waste Management”
18. DOE M 435.1, ”Radioactive Waste Management Manual”

Appendix A

Brookhaven National Laboratory

Assessment and Implementation Plan

for Compliance with

DOE Order 435.1 "Radioactive Waste Management"

Note: This document represents the assessment of the Laboratory's state of compliance with the Order at the time of the Order's initial issuance. In areas where the Laboratory was not in compliance, actions were defined to achieve compliance. All actions necessary to achieve compliance have been implemented as of March 2003.

Brookhaven National Laboratory
Assessment and Implementation Plan
for Compliance with
DOE Order 435.1 "Radioactive Waste Management"

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1.0 Background

DOE 5820.2A, Radioactive Waste Management, was issued by the DOE in September 1998. An initial DOE review of this Order was undertaken in 1990 with the object of providing more effective program direction, accountability, and performance assurance. During this initial revision effort, the Defense Nuclear Facilities Safety Board (DNFSB) also began examining low-level waste management within the defense nuclear complex, including DOE's low-level waste management program and practices in terms of its past, present, and future operations, resulting in the issuance of DNFSB Recommendation 94-2, *Conformance with Safety Standards at Department of Energy Low-Level Nuclear Waste and Disposal Sites.*

In May 1995, a revision to 5280.2A (draft DOE 5280.2B) was issued for review by DOE and the DNFSB staff. As the result of a significant level of comments from this review, DOE's Office of Environmental Management (EM) committed to a new approach to revising the radioactive waste management Order, and committed to issuing a draft of the revised Order. The objectives in revising the Order included: (1) incorporate DOE commitments in response to 94-2 and other DNFSB Recommendations into the Order; (2) develop a clear and sound technical basis for the requirements and guidance; (3) incorporate considerations of risk, including the processes being developed under DOE's Integrated Safety Management System; (4) develop less prescriptive and more performance-based requirements; (5) address stakeholder concerns; and (6) address other emerging considerations, such as the movement toward external regulation, legislation requiring the adoption of industry consensus standards, and DOE's ongoing efforts to delegate decision-making and managerial controls from Headquarters to the Field office level.

The revised DOE Radioactive Waste Management Order, as DOE Order 435.1 (O 435.1), with its accompanying Contractor Requirements Document, Manual and Guidance Documents governs the management of DOE's radioactive wastes; high-level waste, transuranic waste, low-level waste, and the radioactive component of mixed waste. DOE O 435.1 was issued on July 9, 1999 and the requirements of the Order apply to all new and existing DOE radioactive waste management facilities, operations, and activities. Implementation of the requirements is to begin at the earliest possible date, and all DOE entities are to be in compliance with the Order within one year of issuance. Compliance with the Order requires implementing the requirements or obtaining DOE approval of an implementation or corrective action plan.

2.0 Compliance Review Methodology and Approach

Brookhaven National Laboratory's (BNL) review of radioactive waste management activities to assess compliance with DOE O 435.1 requirements was performed by the Waste Management Division (WMD). This review was performed by extracting the Order requirements applicable to BNL and documenting the compliance basis for these requirements. O 435.1 is comprised of several documents, including the Order, Contractor Requirements Document, Manual and Guidance Documents. These documents govern the management of DOE's radioactive wastes; high-level waste, transuranic waste, low-level waste, and the radioactive component of mixed waste. The Order and the attached Contractor Requirements Document contain the requirements at the highest level. The Manual provides mandatory Order requirements at a more detailed level and consists of four chapters as follows:

- Chapter I – General Requirements and Responsibilities,
- Chapter II – High-Level Waste Requirements,
- Chapter III – Transuranic Waste Requirements, and
- Chapter IV – Low-Level Waste Requirements.

The Implementation Guide provides additional information and acceptable methods for meeting the Order requirements. The Guide defines that alternative methods may be used to achieve compliance with specific requirements, but must ensure an adequate level of safety commensurate with the hazards associated with the work and be consistent with the radioactive waste management basis.

BNL's review is based on extracting the requirements contained in the Manual (M 435.1-1) Sections I and IV into two tables to serve as a framework for documenting BNL's compliance basis, and identifying any compliance "gaps" requiring corrective action. This documentation of this review is provided as Attachment A – M 435.1-1 Chapter I Compliance Index, and Attachment B – M 435.1-1 Chapter IV Compliance Index. Chapters II and III are not applicable as BNL does not have high-level or transuranic wastes.

The compliance review approach is based on identifying and reviewing existing BNL management systems to ensure that the Order requirements are appropriately addressed. M 435.1-1 Chapter I – General Requirements and Responsibilities, defines the programmatic Order requirements for the management of radioactive waste. In general, these requirements are addressed in BNL institutional level management systems such as the BNL Integrated Safety Management System (ISM), Quality Assurance Program, ISO 14001 "Plus" Environmental Management System, and the Standards Based Management System (SBMS) System Descriptions.

M 435.1-1 Chapter IV – Low-Level Waste Requirements, defines the Order's activity level requirements for the management of radioactive waste. In general, these requirements are addressed in BNL facility and activity level management systems such as the SBMS Subject Areas, and Division/Department Standard Operating Procedures (SOPs).

The Order defines requirements, and organizational roles and responsibilities from the U.S. Department of Energy (DOE) Program Secretarial Officer level to the activity level within the BNL contractor organization. For the purpose of this review, organizational responsibilities above the DOE Field Element Manager (FEM) are not addressed and are assumed to be managed and implemented within the DOE organization. Organizational responsibilities at the DOE FEM level and below, are assumed to be supported directly by the Brookhaven Science Associates organization, and are addressed by this review.

The compliance review for the M 435.1-1 Chapter I and Chapter IV requirements is documented and provided as Attachments A and B, respectively. This compliance review includes the identification of the appropriate BNL institutional, facility, and/or activity level management system(s), a brief discussion of how the management system(s) satisfies the Order requirement, and a reference to the applicable BNL management system(s), generally in the form of an Internet address (URL) to the BNL document. The majority of the referenced management systems are publicly available on the BNL server. Specific references (i.e., Facility Use Agreements) are password protected and not publicly available.

Compliance gaps are identified in Attachment A and B, as appropriate. Where compliance gaps are found, personnel responsible for the impacted BNL management system, and/or departments and divisions involved in the impacted waste management activity have been contacted to discuss and verify the identified gap, and determine the most efficient and effective action and schedule for achieving compliance. Compliance actions are discussed in Section 3.0, and are presented in Table 4-1– BNL O 435.1 Corrective Actions and Schedule. Commitment dates will be entered into the BNL Action Tracking System (ATS) to track the required actions.

This review establishes that management systems are generally in place at BNL to assure compliance with the Order requirements. Verification of implementation of the in place management system is accomplished by routinely performed self-assessment and independent verification activities by others. For completeness, the BNL Assessment Tracking System (ATS - http://ats.bnl.gov/) was reviewed to identify any system deficiencies resulting from such verification activities which impact compliance with the Order requirements. For the purpose of this review, ATS minor deficiencies and system improvement actions are not considered to impact Order compliance. The following system deficiency impacting Order compliance resulted from this ATS review and will be identified in Table 4-1, Corrective Actions and Schedule.

ATS Item Number	Description	ATS Due Date
34.1	BNL needs to revise the October 1993 Waste Minimization Plan in accordance with the new March 1994 guidance.	**5/31/01**

3.0 Compliance Assessment Results

The objective of the Order is to ensure that all DOE radioactive waste management activities are systematically planned, documented, executed, and evaluated in a manner that is protective of worker and public health and safety, and the environment. The Order is performance-based, defining objectives for the management of radioactive waste and not prescribing the implementation approach. Many of the requirements of O 435.1 were contained in the predecessor order, DOE 5820.2A - Radioactive Waste Management. Additionally, the Order broadly references the requirements of other existing regulations and DOE directives. Due to the previous existence of many of the DOE O 435.1 requirements in other regulatory documents, a high level of compliance is expected and achieved by the existing BNL management systems. The Order also includes new requirements that are directed toward the goal of more systematically managing radioactive waste. In these cases, BNL management systems, while adequate to ensure the safety of on-going radioactive waste management activities, require revision to achieve this goal.

The compliance assessment results for Chapter I – General Requirements, and Chapter IV – Low-Level Waste Requirements are discussed as follows:

Chapter I – General Requirements

BNL's existing management systems address the requirements of O 435.1 for all aspects of M 435.1-1 Chapter I, with the exception of the following two items:

I-1. M 435.1-1 Section I.1.E.(20) requires that waste minimization and pollution prevention shall be implemented for radioactive waste management facilities, operations, and activities to meet the requirements of Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements. SBMS does not identify EO 12856 as a system requirement.

An External Requirement Document Record of Decision in accordance with BNL SBMS *"Requirements Management"* is being prepared to address the applicability and implementation of EO 12856.

Additionally, a review of BNL's Assessment Tracking System (ATS Item 34.1) identified an existing action to update the BNL Waste Minimization Plan to current requirements.

I-2. M 435.1-1 Section I.1.E.(5) requires waste management facilities, operations, and activities shall maintain an emergency management program in accordance with DOE O 151.1, Comprehensive Emergency Management System. SBMS does not identify EO 12856 as a system requirement.

Additionally, a review of BNL's Assessment Tracking System (ATS Item 11.2.3) identified and existing BNL action to achieve compliance with O 151.1.

I-3. M 435.1-1 Section I.1.E.(12) requires radioactive waste management facilities, operations, and activities shall develop and maintain a quality assurance program that

meets the requirements of 10 CFR 830.120, Quality Assurance Requirements. BNL's Quality Assurance Manual does not comply with this requirement.

Additionally, a review of the *"ISMS Performance Measurement and Improvement Action Plan"* (PM&PIA) self-assessment activity indicated previously identified gaps with regard to BNL's conformance to 10CFR830.120.

I-4. M 435.1-1 Section I.2.F.(4) defines that Field Element Managers are responsible for the approval of exemptions for use of non-DOE facilities. BNL requests and has previously received approval for such use of non-DOE facilities. However, the process for requesting DOE approval of such exemptions is not currently documented in the BNL management system.

The SBMS *"Radioactive Waste Management"* subject area will be revised to document the requirement for DOE approval, and to clarify the process for requesting DOE approval of exemptions.

Chapter IV – Low-Level Waste Requirements

BNL's management systems address the requirements of O 435.1 for all aspects of M 435.1-1 Chapter IV, with the exception of the following six items:

IV-1. M 435.1-1 Section IV.D defines that low-level waste facilities, operations, and activities shall have a radioactive waste management basis (RWMB) consisting of physical and administrative controls to ensure the protection of workers, the public, and the environment. The Order requires that the RWMB be documented, and defines specific requirements for the RWMB for waste generation, treatment, storage, and disposal activities.

The elements of the RWMB for BNL radioactive waste management facilities, operations, and activities are currently embodied in the institutional level management systems defined in the Standards Based Management System (SBMS), the facility operational safety envelopes as defined in Facility Use Agreements, and the activity level controls as defined in SBMS subject areas and Department/Division Standard Operating Procedures (SOPs).

A RWMB will be developed for DOE's approval to document the existing management systems and controls that comprise the BNL RWMB, to satisfy this Order requirement.

IV-2. M 435.1-1 Section IV.D.(1) defines the waste certification plan for generators as part of the RWMB.

The WMD routinely certifies radioactive waste for transfer to off-site disposal. However, there is no documented programmatic requirement to ensure that all radioactive wastes are certified by the WMD.

An action is in progress to communicate this policy to all BNL Divisions and Departments in the form of a policy memorandum from BNL Director Marburger. The

SBMS *"Radioactive Waste Management"* subject area will be revised to incorporate this as a requirement to satisfy the Order.

IV-3. M 435.1-1 Section IV.E requires the maintenance of contingency storage and transfer capacity for off-normal or emergency situations involving high activity or high hazard liquid low-level waste storage or treatment.

Radioactive liquid waste storage and processing is conducted in various BNL WMD facilities. Liquid radioactive waste stored in double walled tanks with leak detection systems are interpreted to meet the Order requirement. All other BNL WMD storage and treatment facilities have contingency storage capacity available, but administrative controls are not in place to define operator action for off-normal or emergency situations to ensure use and availability of this contingency storage.

BNL WMD SOPs will be revised to define the required administrative controls to satisfy this Order requirement.

IV-4. M 435.1-1 Section IV.N.(2) requires that low-level waste that has an identified path to disposal shall not be stored longer than one year prior to disposal, except for storage for decay, or as otherwise authorized by the Field Element Manager.

Wastes resulting from ERD operations are subject to multi-party agreement in accordance with the CERCLA process, to define the disposition approach, outcome, and schedule commitment as documented in the Record of Decision. Unless otherwise approved by DOE as part of such multi-party agreement, radioactive wastes resulting from ERD operations are subject to the Order requirement. WMD treatment and interim storage activities generally do not result in radioactive wastes being stored for more than one year for waste streams resulting from routine BNL operations. However, this Order requirement is not documented in BNL's management system. Also, this objective is not reasonable for the disposal of non-routine radioactive wastes (e.g., sources, non-contact handled wastes) that are infrequently generated, due to the special handling, packaging and transportation considerations, without resulting in cost inefficiency.

The SBMS *"Radioactive Waste Management"* subject area will be revised to document the Order storage limit requirements for all BNL radioactive wastes, and to contain the DOE approved RWMB as an Appendix. The RWMB will identify those wastes not considered to be routine and the associated duration of allowable storage.

IV-5. M 435.1-1 Section IV.N.(7) requires that staging of low-level waste shall be for the purpose of the accumulation of such quantities of waste as necessary to facilitate transportation, treatment, and disposal, and that staging longer than 90 days shall meet the requirements for storage defined in Chapter I of the Manual.

Although BNL radioactive waste management does not result in the staging of low-level waste for longer than 90 days, this Order requirement is not documented in BNL's management system

The SBMS *"Radioactive Waste Management"* subject area will be revised to satisfy this Order requirement.

4.0 Corrective Actions and Schedule

The corrective actions and commitment dates are provided in Table 4-1 for resolution of non-compliance items.

Table 4-1

Compliance Actions and Schedule

Item No.	O 435.1 Reference	Compliance Gap	Action Plan	Completion Date
I-1	I.1.E.(20)	Waste minimization and pollution prevention shall be implemented for radioactive waste management facilities, operations, and activities to meet the requirements of Executive Order 12856, Federal Compliance with Right-to-Know Laws. SBMS *"Management System Description: Environmental Management System"* does not identify EO 12856 as a system requirement.	A BNL External Requirement Document Record of Decision (ROD) is in development to document the applicability and implementation requirements of EO 12856 for BNL. BNL's Assessment Tracking System (ATS Item 34.1) identifies an existing action to update the BNL Waste Minimization Plan to current requirements and is scheduled for completion by 5/31/01.	12/31/00 5/31/01
I-2	I.1.E .(5)	Radioactive waste management facilities, operations, and activities shall maintain an emergency management program in accordance with DOE O 151.1, Comprehensive Emergency Management System.	Existing corrective actions are defined in BNL's Assessment Tracking System (ATS Item 11.2.3).	9/30/00
I-3	I.2.E.(12)	Radioactive waste management facilities, operations, and activities shall develop and maintain a quality assurance program that meets the requirements of 10 CFR 830.120, Quality Assurance Requirements.	The *"ISMS Performance Measurement and Improvement Action Plan"* (PM&PIA) self-assessment activity has identified several gaps with regard to BNL's conformance to 10CFR830.120. An action plan has been approved for achieving compliance by December 31,2000.	12/31/00
I-4	I.2.F.(4)	DOE radioactive waste shall be treated, stored, and in the case of low-level waste, disposed of at the site where the waste is generated, if practical; or at another DOE facility. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of non-DOE facilities for the storage, treatment, or disposal of DOE radioactive waste.	BNL has requested and received DOE exemption approval for use of non-DOE facilities. The exemption process currently in use is not documented in BNL SBMS. The exemption process will be documented in a revision to the SBMS Radioactive Waste Management subject area.	12/31/00

Table 4-1

Compliance Actions and Schedule

Item No.	O 435.1 Reference	Compliance Gap	Action Plan	Completion Date
IV-1	IV.D	Low-level waste management facilities, operations, and activities shall have a radioactive waste management basis consisting of the physical and administrative controls to ensure the protection of workers, the public, and the environment. The RWMB requires documentation for BNL low-level waste facilities, operations, and activities.	The RWMB for BNL low-level waste management facilities, operations, and activities will be documented as an Appendix to the SBMS Radioactive Waste Management subject area. A draft RWMB will be provided to DOE by December 31, 2000 for review. The final RWMB will be issued by March 31, 2001.	3/31/01
IV-2	IV.D.(1)	The waste certification plan is a required element of the RWMB for generators. There is no programmatic requirement to ensure that all radioactive wastes are certified by the WMD.	The SBMS Radioactive Waste Management subject area will be revised to document this requirement. An interim action is in progress to communicate this BNL programmatic requirement via a policy memorandum by BNL Director Marburger. This interim action will be completed by June 30, 2000.	12/31/00
IV-3	IV.E.(1) IV.E.(2)	Contingency storage capacity and transfer capability are required for off-normal or emergency situation involving high activity or high hazard liquid low-level waste storage or treatment activities. Storage tanks in Buildings 801, 802B, 811 and 870 do not meet this requirement.	Administrative controls to define contingency storage and operator actions will be documented in new and/or revised Waste Management Division Standard Operating Procedures.	12/31/00
IV-4	IV.N.(2)	Low-level waste that has a path to disposal shall not be stored longer than one year, except for decay, or as otherwise authorized by the Field Element Manager. This requirement is not documented in the BNL SBMS.	The requirement for storage not longer than one year for routine low-level radioactive wastes will be documented in a revision to the SBMS Radioactive Waste Management subject area. Low-level wastes not considered to be routine will be defined and the duration of allowable storage will be specified in a revision to the SBMS Radioactive Waste Management subject area.	6/30/01

Table 4-1

Compliance Actions and Schedule

Item No.	O 435.1 Reference	Compliance Gap	Action Plan	Completion Date
IV-5	IV.N.(7)	Staging of low-level waste shall be for the purpose of the accumulation of such quantities of waste as necessary to facilitate transportation, treatment, and disposal. Staging longer than 90 days shall meet the requirements for storage. This requirement is not documented in the BNL SBMS.	The requirement for staging not longer than 90 days will be documented in a revision to the SBMS Radioactive Waste Management subject area.	12/31/00

5.0 Resource Impacts

Revision of the SBMS Radioactive Waste Management Subject Area document will be major, involving approximately 100 hours of labor.

Additionally, two other SBMS Subject Areas will require very minor revisions, involving approximately 20 hours of labor total.

Revision of approximately ten WMD procedures will be required, involving approximately 200 hours of labor.

Training of personnel to these revisions will require approximately an hour per WMD personnel, and fifteen minutes per other affected personnel. Total cost is estimated to be approximately 60 man-hours.

A new requirement to track and report schedules on the 90 day and the storage clocks will require approximately forty hours per year of labor.

Appendix B

Brookhaven National Laboratory

Commercial Disposal Exemption Request

DOE Office of Science Generated Waste Streams

BNL plans to transition Office of Science waste streams from commercial disposal facilities to DOE-administered disposal facilities at a steady pace. DOE Order 435.1 requires the use of DOE facilities for disposal of radioactive waste unless an exemption is obtained. Until recently, with the closure of the Hanford site, BNL's options for bulk non-commercial radioactive waste disposal were few. However, with the certification of the BNL Waste Management Program by the Nevada Test Site (NTS), new opportunities exist for sending BNL radioactive waste to NTS. This transition will focus on large and repetitive radioactive waste streams to NTS first, in order to maximize the return on investment in developing profiles.

The BNL experience with review and approval of profiles by NTS, which as of May 2006 is limited to one fairly innocuous waste stream, indicates that the full cycle of building a profile and the supporting documentation, and negotiating with the NTS radioactive waste management personnel on the profile's contents can be laborious and time-consuming. The current estimate for development and approval of a waste stream profile is over $30,000. Although efficiency may improve with time and experience, the effort will probably always be too expensive to be cost-effective on small, one-time waste streams. The approximate FY06 unit disposal cost for low level radioactive waste at NTS is $13 per cubic foot, and at LANL is $80 per cubic foot, compared to a unit disposal cost of $15 per cubic foot at Energy Solutions. For a waste stream to be cost-effectively profiled and sent to NTS, it would have to be one that would eventually total to more than 15,000 cubic feet at current rates in order to offset the minor difference in disposal cost.

The Waste Management Program at BNL handles three repetitive waste streams that have potential over several years to exceed this volume. They are:

1. Activated Metal from the Collider Accelerators
2. Solidified Liquid Low Level Waste
3. Rad-contaminated Personal Protective Equipment.

In FY06 and the first half of FY07, BNL intends is to develop and submit these three profiles, with shipping to NTS beginning by mid-FY07. Upon successful completion of these profiles, BNL will re-evaluate the cost of profile development versus the disposal costs of NTS and other commercial entities and in future revisions of the RWMB other, smaller waste streams will be targeted if they appear to be cost-effectively addressed to NTS.

Waste streams that cannot be accepted by DOE-managed facilities will continue to be directed to commercial entities. Waste streams that are not cost-effective to profile to NTS per the above logic will continue to be directed to commercial entities.

DOE personnel attend WM planning meetings and are notified in advance of any shipment of radioactive waste. Hence, DOE monitors WM activities in sufficient detail to be assured that this process is being actively pursued, and has the opportunity to question the rationale for commercial shipments in advance.

DOE Environmental Management (EM) Generated Waste Streams

As discussed above, the BNL experience with review and approval of profiles by NTS, which as of May 2006 is limited to one fairly innocuous waste stream, indicates that the full cycle of building a profile and the supporting documentation, and negotiating with the NTS radioactive waste management personnel on the profile's contents can be laborious and time-consuming. The current estimate for development and approval of a waste stream profile is over $30,000. Although efficiency may improve with time and experience, the effort will probably always be too expensive to be cost-effective on small, one-time waste streams. The approximate FY06 unit disposal cost for low level radioactive waste at NTS is $13 per cubic foot, and at LANL is $80 per cubic foot, compared to a unit disposal cost of $15 per cubic foot at Energy Solutions. For a waste stream to be cost-effectively profiled and sent to NTS, it would have to be one that would eventually total to more than 15,000 cubic feet at current rates in order to offset the minor difference in disposal cost.

BNL's EM waste streams are addressed in the spreadsheets that follow this discussion. In summary, EM believes the DOE is best served by allowing disposal of the small-volume waste streams at Energy Solutions. The development and negotiation of profiles with NTS, in addition to the specialized and expensive packaging required for NTS, result in an extremely skewed cost-benefit ratio for these small waste streams favoring Energy Solutions. Large volume waste streams also are more cost effective to send to Energy Solutions, as the cost savings from use of rail shipment to Energy Solutions versus the use of trucks to NTS overwhelms the minor difference in cost of disposal. The graphite pile from the Brookhaven Graphite Research Reactor is intended for disposal at NTS, and is not discussed in detail in the attached spreadsheets.

It is anticipated that in FY06 EM will produce no more than 1,000 cubic feet of radioactive waste, which, even were it one homogeneous waste stream subject to only one profile development campaign, would be very inefficient to dispose at NTS. BNL proposes to send all EM-generated waste to commercial disposal in FY06.

In FY07 the predominant waste stream generated by EM is the graphite pile from the Brookhaven Graphite Research Reactor (BGRR) and the secondary waste associated with the disassembly of the pile. The graphite waste stream is being profiled to NTS, and if negotiation is successful in providing a path to NTS, the graphite will be sent there for burial. The secondary waste stream from the pile disassembly is significantly less than 15,000 cubic feet, and BNL proposes to dispose of it at Energy Solutions.

In FY07/FY08 there is a large volume of EM waste predicted to be generated from the large volume decommissioning projects associated with the BGRR Bioshield, High Flux Beam Reactor stack, fanhouse and other facilities. The cost benefit analyses for these waste streams are detailed in the attached spreadsheets, but in summary, the transportation element dominates the disposal costs, and results in a cost savings to the DOE of about $10 Million dollars when waste is shipped to Energy Solutions via train when compared to shipping to NTS via truck. Therefore BNL proposes to use Energy Solutions as the disposal facility for this waste.

These cost estimates will be re-evaluated annually during the annual revision to the RWMB, in order to verify the assumptions and conclusions in the face of changes in disposal costs or other contributors to the equation.

EM Waste for FY06 RWMB

LLRW Disposal Evaluation - NTS vs. Energy Solutions (see General Notes)

Energy Solutions Option

Waste Description	Volume (yd3)	Disposal Costs	Intermodal Costs w/T&D (note 1,5)	Sealand Costs (note 1)	Supersack & Super Load Wrapper Costs	Truck Costs (note 2,11,12)	Flatcar Costs (note 11)	Gondola Costs (note 11)	Rail repair	on site truck to WLA (crane reqd)
Standard LLRW	3776	$1,719,794	$999,000	$129,200	$182,000	$756,395	$795,708	$1,376,520	$350,000	$397,500
Oversize LLRW	832	$445,885	*	*	*	*	*	*	*	*
Soil	5276	$777,788	*	*	$65,475	*	*	*	*	*
Total Volume (ES)	9884									
Subtotal Costs:		$2,943,467	$999,000	$129,200	$247,475	$756,395	$795,708	$1,376,520	*	*

Grand Total - Energy Solutions Option: $7,995,265

NTS Option

Waste Description	Volume (yd3)	Disposal Costs	Intermodals Required (note 4)	Intermodal Costs w/disposal	Sealands Required	Sealand Costs	Supersack Costs	Truck Transport Costs (note 2,11)	on site truck to 865 (forktruck only)	NTS Profile costs
LLRW	9884	$3,482,522	1144	$5,655,524	0	$0	$182,000	$7,433,954	$285,921	$180,000
Subtotal Costs:		$3,482,522	1144	$5,655,524	0	$0	$182,000	$7,433,954	*	*

Grand Total - NTS Option: $17,219,921

Vendor Quotes FY2006 Pricing		
Energy Solutions LLRW (Debris)	455.49	cuyd
Energy Solutions LLRW (O/S)	535.92	cuyd
Energy Solutions LLRW (soil)	147.42	cuyd
NTS	352.35	cuyd
One Way Truck to Disposal	6,500	one way
MHF IM's	5750	cost plus disp.
MHF Sealand (ES rental)	3800	rental plus mob/ea
MHF supersack	280	purchase/each
MHF super load wrapper	485	purchase/each
MHF flatcar	25668	one way
MHF gondola	11471	one way
NTS Profile Preparation	30000	each

General Notes:
A. This evaluation does not include mixed waste, because mixed waste has a complex wide exemption.
B. Graphite waste is not included since it is assumed to be disposed at NTS in all cases.
C. Waste considered for Subtitle D disposal facility is not included.

Basis of Estimate:
1. Assumes purchase & re-use of intermodals for ES / Purchase and no re-use for NTS (*see below).
2. Truck costs based on FY2006 actual transport event costs
3. Truck transport costs based on 1-way shipment
4. Intermodal requirements based on 35,000 max capacity for DOT over the road transport.
5. ES includes cost of returning empty intermodals with 2 empty intermodals per return truck
6. HP survey costs higher for NTS option, as one survey per gondola costs less than 5 surveys for trucks
7. Onsite truck costs higher for WLA/ES option because of crane transfer at railcar
8. No new ES profiles assumed as existing profiles cover waste streams. Assumed 6 NTS profiles required
9. Hanford disposal not evaluated. Assumed more costly than NTS because farther away/ no rail access
10. Additional costs for WCO and NTS program maintenance unquantified but higher than ES
11. Rail rates include a 15% fuel charge, Truck rates do not include a fuel charge, which would increase NTS costs
12. ES truck costs include actual truck volume plus a 10% total waste volume contingency

*NTS Intermodal dumping restrictions which make re-use options non-cost effective:
1) No PPE or Combustible materials
2) < 5mr/hr contact & <5mr/hr @ 30cm from waste (otherwise special handling charges apply)
3) No piece larger than 3' any dimension which would require additional labor for size reduction
4) Maintain 18" clearance from top of container
5) No mixing debris and soil
6) Blocking & Bracing to ensure end door has no waste resting on it
7) 18mil liner secured around waste (not attached to Intermodal)
8) Intermodal weight must not exceed 35,000lbs

EM Waste for FY06 RWMB

Waste Big Picture Comparison - Energy Solutions (ES) vs. Nevada Test Site (NTS)

Item Description	Totals	306 BGRR In-Core Removals	305 BGRR Graphite Pile	323 Bioshield	324 DSB Demo & Eng Cap Instl	412 BOP Bldg Demo	413 Fan Houses Demo	414 Stack Demo	415 HFB Underground Utilities	416 HFBR Legacy Waste	417 Post D&D Restoration (WLA Soils)
Waste Type											
					Manifested Waste Volume (cubic yards)						
LLRW Debris (ES) (vol - yd3)	3776	10.7	276	2094	82	83	1114	0	86	30	
O/S LLRW Debris (vol - yd3)	832	0	191	31	168	28	389	0	0	5	20
LLRW Soil (ES) (vol - yd3)	5276	0	0	445	0	0	1072	0	85	0	3674
Waste Packages											
Intermodals - E-care (no. used) (notes 2, 3,)	111	0	18	33	3	0	50	0	7		
Sealands - ES (no. used)	34	1	0	0	6	4	14	0	7	2	
96 ft3 supersacks (no. used)	650	0	0	650	0	0	0	0	0		
262 ft3 supersacks (no. used)	135	0	0	0	0	0	126	0	9		
Transportation											
ABC Flatcars - ES (no. shipments)	31	0	5	7	0	1	16	0	2		
Open Flatbed Truck - ES	2	2	0	0	0	0	0	0	0		
Gondolas - ES (no. shipments)	120	0	0	44	0	0	18	0	2		56

Intermodal Purchase

	Quantity	Cost	Disposal	Total Cost
No. Intermodals Req'd	111	$555,000	$83,250	$638,250